



# 8224 CLOCK GENERATOR AND DRIVER FOR 8080A CPU

- Single Chip Clock Generator/Driver for 8080A CPU
- Power-Up Reset for CPU
- Ready Synchronizing Flip-Flop
- Advanced Status Strobe
- Oscillator Output for External System Timing
- Crystal Controlled for Stable System Operation
- Reduces System Package Count
- Available in EXPRESS — Standard Temperature Range
- Available in 16-Lead Cerdip Package (See Packaging Spec, Order # 231369)

The Intel 8224 is a single chip clock generator/driver for the 8080A CPU. It is controlled by a crystal, selected by the designer to meet a variety of system speed requirements.

Also included are circuits to provide power-up reset, advance status strobe, and synchronization of ready.

The 8224 provides the designer with a significant reduction of packages used to generate clocks and timing for 8080A.

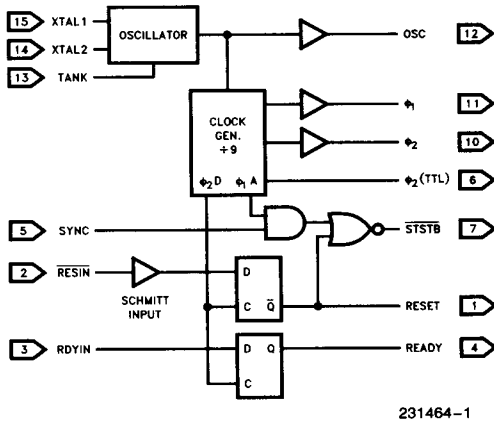
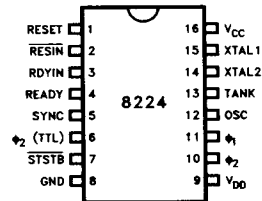


Figure 1. Block Diagram



231464-2

RESIN	Reset Input	XTAL 1	} Connections for Crystal
RESET	Reset Output	XTAL 2	
RDYIN	Ready Input	TANK	Used with Overtone XTAL
READY	Ready Output	OSC	Oscillator Output
SYNC	Sync Input	$\phi_2$ (TTL)	$\phi_2$ CLK (TTL Level)
STSTB	Status STB (Active Low)	VCC	+5V
$\phi_1$	} 8080 Clocks	VDD	+12V
$\phi_2$		GND	0V

Figure 2. Pin Configuration

**ABSOLUTE MAXIMUM RATINGS\***

Temperature Under Bias .....0°C to +70°C  
 Storage Temperature ..... -65°C to +150°C  
 Supply Voltage, V<sub>CC</sub>..... -0.5V to +7V  
 Supply Voltage, V<sub>DD</sub>..... -0.5V to +13.5V  
 Input Voltage ..... -1.5V to +7V  
 Output Current .....100 mA

NOTICE: This is a production data sheet. The specifications are subject to change without notice.

*\*WARNING: Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.*

**D.C. CHARACTERISTICS**

T<sub>A</sub> = 0°C to +70°C, V<sub>CC</sub> = +5.0V ±5%, V<sub>DD</sub> = +12V ±5%

Symbol	Parameter	Limits			Units	Test Conditions
		Min	Typ	Max		
I <sub>F</sub>	Input Current Loading			-0.25	mA	V <sub>F</sub> = 0.45V
I <sub>R</sub>	Input Leakage Current			10	μA	V <sub>R</sub> = 5.25V
V <sub>C</sub>	Input Forward Clamp Voltage			1.0	V	I <sub>C</sub> = -5 mA
V <sub>IL</sub>	Input "Low" Voltage			0.8	V	V <sub>CC</sub> = 5.0V
V <sub>IH</sub>	Input "High" Voltage	2.6			V	Reset Input
		2.0			V	All Other Inputs
V <sub>IH</sub> -V <sub>IL</sub>	RESIN Input Hysteresis	0.25			V	V <sub>CC</sub> = 5.0V
V <sub>OL</sub>	Output "Low" Voltage			0.45	V	(φ <sub>1</sub> , φ <sub>2</sub> ), Ready, Reset, STSTB I <sub>OL</sub> = 2.5 mA
				0.45	V	All Other Outputs I <sub>OL</sub> = 15 mA
V <sub>OH</sub>	Output "High" Voltage φ <sub>1</sub> , φ <sub>2</sub>	9.4			V	I <sub>OH</sub> = -100 μA
	READY, RESET	3.6			V	I <sub>OH</sub> = -100 μA
	All Other Outputs	2.4			V	I <sub>OH</sub> = -1 mA
I <sub>CC</sub>	Power Supply Current			115	mA	
I <sub>DD</sub>	Power Supply Current			12	mA	

**NOTE:**

1. For crystal frequencies of 18 MHz connect 510Ω resistors between the X1 input and ground as well as the X2 input and ground to prevent oscillation at harmonic frequencies.

**Crystal Requirements**

Tolerance: 0.005% at 0°C-70°C  
 Resonance: Series (Fundamental)\*  
 Load Capacitance: 20 pF-35 pF  
 Equivalent Resistance: 75Ω-20Ω

Power Dissipation (Min): 4 mW

**\*NOTE:**

With tank circuit use 3rd overtone mode.



## A.C. CHARACTERISTICS

Symbol	Parameter	Limits			Units	Test Conditions
		Min	Typ	Max		
$t_{\phi 1}$	$\phi_1$ Pulse Width	$\frac{2t_{cy}}{9} - 20$ ns			ns	$C_L = 20$ pF to 50 pF
$t_{\phi 2}$	$\phi_2$ Pulse Width	$\frac{5t_{cy}}{9} - 35$ ns				
$t_{D1}$	$\phi_1$ to $\phi_2$ Delay	0				
$t_{D2}$	$\phi_2$ to $\phi_1$ Delay	$\frac{2t_{cy}}{9} - 14$ ns				
$t_{D3}$	$\phi_1$ to $\phi_2$ Delay	$\frac{2t_{cy}}{9}$		$\frac{2t_{cy}}{9} + 20$ ns		
$t_R$	$\phi_1$ and $\phi_2$ Rise Time			20		
$t_F$	$\phi_1$ and $\phi_2$ Fall Time			20		
$t_{D\phi 2}$	$\phi_2$ to $\phi_2$ (TTL) Delay	-5		+15	ns	$\phi_2$ TTL, $C_L = 30$ $R_1 = 300\Omega$ $R_2 = 600\Omega$
$t_{DSS}$	$\phi_2$ to $\overline{STSTB}$ Delay	$\frac{6t_{cy}}{9} - 30$ ns		$\frac{6t_{cy}}{9}$	ns	$\overline{STSTB}$ , $C_L = 15$ pF $R_1 = 2K$ $R_2 = 4K$
$t_{PW}$	$\overline{STSTB}$ Pulse Width	$\frac{t_{cy}}{9} - 15$ ns			ns	
$t_{DRS}$	RDYIN Setup Time to Status Strobe	$50$ ns - $\frac{4t_{cy}}{9}$				
$t_{DRH}$	RDYIN Hold Time after $\overline{STSTB}$	$\frac{4t_{cy}}{9}$				
$t_{DR}$	RDYIN or RESIN to $\phi_2$ Delay	$\frac{4t_{cy}}{9} - 25$ ns			ns	Ready & Reset $C_L = 10$ pF $R_1 = 2K$ $R_2 = 4K$
$t_{CLK}$	CLK Period			$\frac{t_{cy}}{9}$	ns	
$f_{max}$	Maximum Oscillating Frequency			27	MHz	
$C_{in}$	Input Capacitance			8	pF	$V_{CC} = +5.0V$ $V_{DD} = +12V$ $V_{BIAS} = 2.5V$ $f = 1$ MHz

**NOTE:**

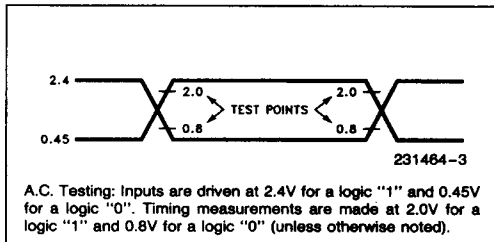
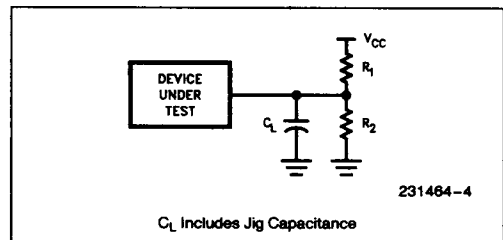
These formulas are based on the internal workings of the part and intended for customer convenience. Actual testing of the part is done at  $t_{cy} = 488.28$  ns.

**A.C. CHARACTERISTICS** (Continued)

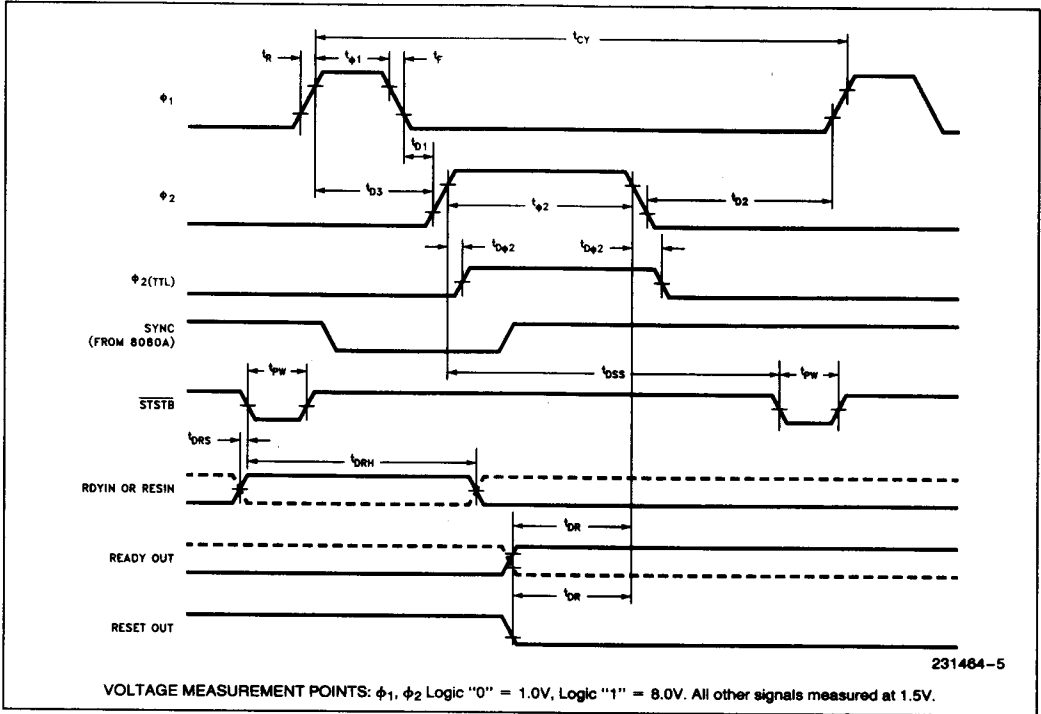
 For  $t_{CY} = 488.28 \text{ ns}$ ;  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = +5V \pm 5\%$ ,  $V_{DD} = +12V \pm 5\%$ 

Symbol	Parameter	Limits			Units	Test Conditions
		Min	Typ	Max		
$t_{\phi 1}$	$\phi_1$ Pulse Width	89			ns	$t_{CY} = 488.28 \text{ ns}$  $\phi_1$ & $\phi_2$ Loaded to $C_L = 20 \text{ pF}$ to $50 \text{ pF}$  Ready & Reset Loaded to $2 \text{ mA}/10 \text{ pF}$ All measurements referenced to $1.5V$ unless specified otherwise.
$t_{\phi 2}$	$\phi_2$ Pulse Width	236				
$t_{D1}$	Delay $\phi_1$ to $\phi_2$	0				
$t_{D2}$	Delay $\phi_2$ to $\phi_1$	95				
$t_{D3}$	Delay $\phi_1$ to $\phi_2$ Leading Edges	109		129		
$t_r$	Output Rise Time			20		
$t_f$	Output Fall Time			20		
$t_{DSS}$	$\phi_2$ to $\overline{STSTB}$ Delay	296		326		
$t_{D\phi 2}$	$\phi_2$ to $\phi_2$ (TTL) Delay	-5		+15		
$t_{PW}$	Status Strobe Pulse Width	40				
$t_{DRS}$	RDYIN Setup Time to $\overline{STSTB}$	-167				
$t_{DRH}$	RDYIN Hold Time after $\overline{STSTB}$	217				
$t_{DR}$	READY or RESET to $\phi_2$ Delay	192				
$f_{MAX}$	Oscillator Frequency			18.432		

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**A.C. TESTING, INPUT,  
OUTPUT WAVEFORM**

**A.C. TESTING LOAD CIRCUIT**


**WAVEFORMS**



**CLOCK HIGH AND LOW TIME (USING X1, X2)**

